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Proceedings of the Marine Fisheries Subcommittee Regional Advisory Process Maritimes Region

26-30 October 1998

Holiday Inn
Dartmouth, Nova Scotia

M.M. Sinclair, Chairman

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ABSTRACT

These proceedings record the discussions held during the autumn 1998 Regional Advisory Process (RAP) Marine Fisheries Subcommittee meeting. The meeting was held at the Holiday Inn, Dartmouth during 26-30 October, 1998. The management units considered were 4X haddock, 4X cod, 4VWX silver hake, 4VWX/5Zc pollock, cusk, 4VWX/5Zc white hake, 4VsW winter skate, harbour porpoise and spiny dogfish NAFO Subareas 2-6. In addition, a review of the 1998 oceanographic conditions of the Scotia-Fundy area was provided. The proceedings outline the main points of discussion, problem areas and recommendations for further work. Stock Status Reports (SSRs) and Fisheries Status Reports (FSRs) for the management units and fisheries management issues were prepared.

RÉSUMÉ

Le présent compte rendu relate les discussions ayant eu lieu à la réunion du Sous-comité des poissons de mer tenue à l'Holiday Inn de Dartmouth, du 26 au 30 octobre 1998, dans le cadre du processus consultatif régional (PCR) de l'automne 1998. Les unités de gestion à l'étude étaient les suivantes : aiglefin de 4X , morue de 4X, merlu argenté de 4VWX, goberge et brosme de 4VWX/5Zc, merluche blanche de 4VWX/5Zc, raie tachetée de 4VsW, ainsi que marsouin et aiguillat communs des sous-zones 2 à 6 de l'OPANO. On a également procédé à un examen des conditions océanographiques de 1998 dans le secteur de Scotia-Fundy. Le compte rendu décrit les principaux sujets traités, les questions problématiques et les recommandations de plus amples travaux. Des rapports sur l'état des stocks (RES) et des rapports sur l'état des pêches (REP) ont été établis pour les unités de gestion et les questions de gestion des pêches considérées.

INTRODUCTION

The meeting was opened by the Chair, Mike Sinclair, who welcomed the participants. In his introductory remarks the objectives of the meeting were reviewed and the agenda accepted (Appendix 3). It was pointed out that under the new responsibilities for the Regional Advisory Process (RAP), the Chair (on behalf of the respective subcommittees) approves the final documentation that arises from the meetings [i.e. Stock Status Reports (SSRs) and Fisheries Status Reports (FSRs)]. Previously the ADM Science (Scott Parsons) approved the SSRs, and the RD-G (Neil Bellefontaine) the FSRs. The participants are listed in Appendix 1, and the documents tabled at the meeting are listed in Appendix 4. The recommendations made during the meeting are collated in Appendix 5, and the minutes of the meetings of the Marine Fish Division (BIO site) Stock Assessment Working Group are in Appendix 6. It was indicated that a new category of documentation was being introduced at this meeting on a trial basis. Updates on the management units that were not being reviewed were being tabled at the meeting, but would not be peer reviewed. These updates for eastern Scotian Shelf cod, cod in Sydney Bight, eastern Scotian Shelf haddock, southwest Nova winter flounder, American plaice and yellowtail flounder, eastern Scotian Shelf American plaice, yellowtail and winter flounder, witch flounder in 4VWX, Scotian Shelf and southern Grand Bank halibut, Northwest Atlantic (NAFO subareas 2-6) spiny dogfish, monkfish on the Scotian Shelf and northeast Georges Bank, include the outlook from the previous peer reviewed SSR as well as new information on the fishery and the results of the research vessel surveys. The 1998 research documents on the respective surveys were also tabled as background information in support of the updates.

ENVIRONMENTAL OVERVIEW: SCOTIAN SHELF AND BAY OF FUNDY

Working Papers:

Drinkwater, K.F., D.B. Mountain and A. Herman. Recent changes in the hydrography of the Scotian Shelf and Gulf of Maine - A return to conditions of the 1960s? WP 98/114.

Losier, R., F. Page, P. McCurdy, M. Ringuette and J. McRuer. 1997. Overview of 1998 hydrographic sampling effort and near-bottom water temperature and salinity conditions during the Canadian research vessel groundfish summer surveys conducted on the Scotian Shelf and the Bay of Fundy (4VWX). WP 98/116

Losier, R., F. Page, P. McCurdy, M. Ringuette and J. McRuer. 1998. Overview of 1998 hydrographic sampling effort and near-bottom water temperature and salinity conditions during the Canadian research vessel groundfish summer surveys conducted on the Scotian Shelf and the Bay of Fundy (4VWX). WP 98/117

Rapporteur: Ken Frank

The key points of discussion were:

- Presentation summarized recent temperature and salinity conditions on the Scotian Shelf based on observations made during recent RV surveys, monitoring programs, and industry surveys.

- Beginning in September/October 1997, the deeper waters of Emerald Basin became colder and less saline; this was caused by intrusion of slope water originating from the Labrador Current (identified as Labrador slope water or LSW).

- Early in 1998, the influence of LSW extended to the southwest and was evident in the NE Channel and the southern flank of Georges Bank.

- Bottom water temperatures from the July RV survey revealed a 2-3°C decline in the deep basins relative to 1997.

- Most of the Scotian Shelf is now colder-than-normal with the most significant change occurring in the southwestern areas and a slight moderating of the temperatures in the northeast.

- Questions about how recent cooling in Div. 4W and 4X would effect productivity were answered as follows: temperature effects on growth of cod and haddock have been well documented such that lower temperatures results in reduced growth; temperature effects on the productivity at the trophic levels are not well understood.

No new analyses were requested during the meeting. A single recommendation for future work was made:

- Develop a rapid method of incorporating temperature and salinity data collected during industry surveys into the standard databases used to evaluate environmental patterns in the Scotian Shelf/Gulf of Maine area.

4X HADDOCK

Working Papers:

Hurley, P.C.F., G.A.P. Black, P.A. Comeau and R.K. Mohn. Assessment of 4X haddock in 1997 and the first half of 1998. WP 98/121

Van Eeckhaute, L. Update of haddock in 4Xs (New Brunswick side of Bay of Fundy). WP 98/122

Rapporteur: Steve Campana

The key points of discussion were the following:

The Fishery

- Industry comments indicate that there has been no substantive shift in effort towards eastern 4X in 1998, at least to the east of the Roseway. However, there has been a little more targeting of haddock relative to cod and other species.

- It was unclear initially why small fish appeared to be underrepresented in the 1998 catch, given that there were a number of closures for small fish. However, the length composition of the catches correctly showed the small fish. Therefore, the discrepancy was probably not very large, and may have been due to the use of RV weights at age in the projection (which tend to be smaller than those caught commercially) and declining size trends. In addition, the figure comparing predicted and observed catches may not have been corrected for the overestimated 1993 and 1994 year-classes.

Resource Status

- The top panel of the age bias plot (Fig. 16) has the primary and secondary axes reversed, the revised panel needs to be inserted.

- There has been a major decline in size at age (up to 50%) over the past 20 years, only a small portion of which can be explained by declines in condition factor. The decline has continued in recent years. However, a cause has not been proposed. It was also not clear why two relatively large year-classes were produced during this period, at a time when spawning potential might have been expected to have declined. In general, if spawning potential and year-class strength tend to be smaller at times of low condition factor, the recent low levels of condition factor suggest that upcoming recruitment may be somewhat lower than average.

- The influence of the reduced spatial coverage of the 1995 ITQ survey was discussed. Biomass estimates for the 1996-98 ITQ surveys were most comparable, since there was similar coverage for those years.

- The comparison of the ADAPT population trend with that of the RV and ITQ indices was somewhat dissimilar for the most recent years (whereby the RV and ITQ show declines over the most recent 3 years, and the ADAPT shows constancy), but this was probably due in part to the fact that the ADAPT estimates were not corrected for overestimation of the 1993 and 1994 year-classes. It was agreed that all population trends based on the accepted model should incorporate corrections for the size of the 1993 and 1994 year-classes, and if possible, the overall retrospective problem.

Outlook

- Catch projections should be based on commercial weights at age, while population biomass can be based on RV weights at age.

- It was agreed that reconstruction of the stock-recruitment curve prior to 1970 would be useful, given that the stock reconstructions already exist. However, current estimates of spawning stock biomass assume a constant maturity ogive. Since such constancy is unlikely (and may have produced an increased age of maturity as a result of the reduced size at age), current estimates of SSB may be biased. This should be compared with stock-recruitment based on RV alone.

- To insure that the ADAPT is giving realistic population trends, it would be useful to see a comparison of RV Zs and ADAPT Fs for ages 5-7.

The following new analyses were requested to be done during the meeting:

- Apply Gompertz correction to both 1993 and 1994 year-classes.
- Add Gompertz-corrected terminal year to population trends (e.g. Figs. 33, 35, 36).
- Reconstruct VPA-based stock-recruitment curve prior to 1970. Compare with stock-recruitment curve based only on RV data.
- Compare Zs from RV with Fs from ADAPT for ages 5-7.
- Prepare catch projections based on commercial weights at age, although population biomass trend can be based on RV weights at age.

No recommendations for future work were made.

4X COD

Working Paper:

Clark, D. Assessment of cod in Division 4X in 1998. WP 98/120

Rapporteur: Ken Frank

The key points of discussion were:

The presentation summarized recent events in the 4X cod fishery, reviewed recent surveys, and provided different scenarios on population dynamics making assumptions about changes in natural mortality and survey catchability. Summary points included:

- The recent fishery has been poor throughout the inshore area and extremely poor in some areas.

- The proportion of landings coming from cod aged 5+ continues to be lower than anticipated and the standard assessment formulation projects 50% of the 1999 landings coming from ages 7+; these cohorts are contributing less than 35% in 1998.

- The 1996 year-class is expected to result in an increase in biomass; although this year-class is below the long-term average it is stronger than the three year-classes preceding it.

- Historical observations revealed several discrete spawning locations within the 4X management unit and the long-term stability of the resource may be a consequence of this diversity; concerns were raised about the elimination of some spawning components, particularly in nearshore areas.

Several points were raised after the presentation including:

- Protection of spawning components is a priority objective for the FRCC and means of achieving this goal should be considered; subdivision of 4X into smaller units for analysis of the population dynamics has been considered (e.g. Bay of Fundy vs. Scotian Shelf) but appears to be impractical at finer spatial scales.

- There were many questions on the issue of effort shift to the Bay of Fundy; it was noted that a Fisheries Status Report was prepared and reviewed on the effort shift issue and that the detailed analyses contained in the report provides information on many of the points raised in the discussion.

- 1998 was considered an odd environmental year both from an industry and DFO Science perspective: industry noted changes in distribution and timing of spawning of several species; absence of dogfish, etc.; the environmental overview conducted by Science revealed a significant cooling of the bottom waters on the southwestern Scotian Shelf.

- Considerable discussion centered on changes in catchability of cod with the suggestion that a higher proportion of the population is available to the survey than occurred historically.

- There were questions about correspondence between the U.S. and Canadian surveys and making comparisons among them based only on geographically overlapping areas; unfortunately ageing data does not exist prior to 1987 for the US surveys.

- Some industry representatives stated that 4X cod currently have a parasite load that resembles the situation that existed for 4VsW cod a decade ago; others considered that many of recent changes in 4X cod were similar to changes that were associated with the collapse of other cod stocks.

The following new analyses were requested to be done during the meeting:

- The analysis of the shift in effort has generated some confusion because of the geographical definition of the Bay of Fundy to include its approaches and the area extending onto German Bank (i.e. 4Xq, r, and s). All reported effort shift analyses should include a map to identify the area designated as the Bay of Fundy.

- Prepare a graphical representation of the RV and ITQ surveys for inclusion in the SSR.

- Calculate total mortality estimates (Zs) from the ITQ survey ages 4-6.

- Concerns were raised about the ability of the RV survey to track cohorts through to older ages (6+); a VPA run restricting the calibration block to ages 2-6 and 2-7 was requested (note: the run would also include the ITQ index); depending on the outcome of this analysis, provide a tabular summary of the pro's and con's of the various formulations considered.

- Prepare a stock-recruitment plot based on survey data alone.

The following recommendations were made for future work:

- Conduct an examination of all available seasonal surveys to look for characteristic patterns of distribution that might be indicative of population structure and evaluate the degree to which it has changed over time.

- Consider using a GIS-based approach to developing an abundance index for cod from the ITQ survey.

- Calculate weights at age from the research vessel surveys.

4VWX SILVER HAKE

Working Papers:

Branton, R. Effects of Scotian Shelf small mesh gear fishery regulations on the catch rate of silver hake and bycatch rates of cod, haddock and pollock in the period 1983-98. WP 98/125

Showell, M.A. *et al.* Assessment of the Scotian Shelf silver hake population in 1997, with projection of yield to 1999. WP 98/124

Rapporteur: Ralph Halliday

The Fishery

Were TACs restrictive? - Historically, some were set too high reflecting perhaps an unrecognized retrospective problem. However, large portions of the TAC reserved for new participants (e.g. Canada) were regularly unutilized, whereas allocations to the main participants (particularly the USSR) were often restrictive.

Why are fish caught by the domestic fishery smaller (younger) than foreign catches? - The same mesh size is in effect in foreign and domestic fisheries and both are required to use grates, so selection of gears is expected to be the same. This difference appears to be an effect of area of fishing, smaller fish occurring in the basins. The basins could be juvenile distribution areas. This is not a completely new idea but development of the domestic fishery in these basins makes this a more important issue and has caused a closer look to be taken at available data this year. RV data show a similar difference in size distributions, so the difference is real.

Why are there no data on age composition for 1998 domestic fishery? - Otoliths require some months to clear, so there was no time to read these.

Do foreign catch rates continue to reflect stock abundance? - USSR fleet left the fishery after 1993 but earlier analysis showed Cubans to have comparable catch rates. There is some evidence that Cubans have stayed in the area after the main migration of silver hake into shallower waters and continued to fish in the hope of catch rate improvements. If so, there are grounds for concern that this is biasing catch rates downwards. Cold water along the slope in 1998 may also have affected catch rates. Soviet research indicates that silver hake are more dispersed in cold water conditions, reducing fishing success.

Is it agreed that the domestic catch rate series is too short to be used as an abundance index? - Yes, due to effects of learning. Also, the fishery in 1997 is still 98% in Emerald Basin only and the CPUE may not reflect abundance in whole basin area. Here also, cold water inflow in late 1997 resulted in colder conditions in 1998, although catch rates were not obviously affected.

Reduction of bycatches:

a) Are there data on survival of fish escaping from the separator grate? - Video footage of the escapement process suggests that damage to escaping fish should be minimal, but there are no experimental data on survival.

b) Is it agreed that the 1994 SMGL should be strictly adhered to? The original 1994 line was drawn up without consultation with participants in one shelf edge fishery and it created some practical difficulties, particularly by excluding some canyons. These difficulties needed to be addressed to ensure that a viable fishery could be conducted. It was noted that there were no data presented on bycatches in the basin fishery. It was answered that data on this issue are

inadequate. An industry participant indicated that bycatches were not a problem in the basins.

It was requested that a draft Fishery Status Report be prepared on the issue of the SMGL for the Subcommittee's consideration.

Are there silver hake bycatches in other fisheries? - No.

Biology

Stock definition - It was agreed that Bay of Fundy fish were likely more closely associated with the Gulf of Maine/ northern Georges Bank stock and that these fish should not be considered in the assessment of the Scotian Shelf stock. The question was raised as to whether basin and shelf edge fish belonged to separate populations. Opinion to date has been that they are one stock and survey distributions do not show a discontinuity.

It was recommended that the relationship of basin and shelf edge populations be further investigated. e.g., by looking for differences in length and weight at age and by mapping distributions by life history stage and age group.

Growth and condition - Do reductions in condition, and length and weight at age, for silver hake show the same pattern as other species on the Scotian Shelf? Haddock agrees generally. Maturity at length, and at age, is also declining.

It was recommended that changes in population parameters for all Scotian Shelf stocks should be examined in relation to possible causative factors, and the effects of these changes on productive capacity should be described.

Resource Status and Outlook

Calibration of VPA - The commercial catch rate at age 1 should be left out of future calibrations as the relationship with VPA age 1 is poor.

Residual patterns - The pattern of residuals looks quite good (except for commercial catch rate at age 1).

Retrospective pattern - There is a definite bias but this is rather small compared to other stocks showing this problem.

VPA results - Additional presentations of the data were requested in graphical form:
- SSB from VPA for historical period in relation to estimate for 1998
- SSB from RV survey for historical period in relation to estimate for 1998
- SSB versus recruitment from VPA
- Risk plots on projections.

Cautions - A number of factors were listed that give grounds for caution in accepting the output catch at $F_{0.1}$ from the calculations presented. These were:

- The new basin fishery is catching smaller, younger, fish, effectively reducing the age at first recruitment;
- Weight at age has been declining from the 1970s;
- Commercial catch rates are at their lowest levels in the time series;
- RV survey biomass estimates are the lowest since 1980;
- Spawning stock biomass will decline if the $F_{0.1}$ catch is taken in 1999;
- fishing mortality estimated for most recent years is lower than expected from recorded levels of fishing effort;
- Estimates of total mortality (Z) from surveys do not show a decline in most recent years;
- The last period of cold temperatures in the basins in the 1960s corresponded with a recruitment failure in silver hake and, if the 1997-98 cold water episode persists, another failure cannot be ruled out; and,
- The 1997 year-class is below average strength.

The VPA results show stock size increasing through 1997 and thus results must be unreliable. A counter-argument was made that the VPA stock size in 1997 was consistent with the survey index. The 1998 survey data were not in the calibration, so the VPA results could not be expected to reflect the low RV population estimate in 1998.

There was a view that the VPA results were unreliable, that the data showed the resource to have progressively declined to a very low level, and that the 1999 catch should be reduced substantially below recent average catches. The primary supporting arguments were that weights at age and commercial and survey catch rates had been declining more or less continuously and were now at historic lows.

There was a contrary view that such a conclusion was based on an overly negative interpretation of the evidence. Foreign catch rates in most recent years were from increasingly obsolete and poorly maintained Cuban vessels, likely with decreasing efficiency. This catch rate series has, in any case, been consistently criticized as prone to localized environmental influences. Commercial weights at age are sensitive to changes in the seasonal and spatial pattern of fishing, and are not reliable indices of changes in the stock. RV weights at age have been increasing from a low in 1994, and in 1997 were back to within the range of values in the 1980s. RV biomass, on average in 1995-97 had recovered to 60% of the peak values in 1984-86 when catches were 75-80000 t. The VPA, corrected for the retrospective pattern, provided an acceptable indicator of stock status at the beginning of 1998. Nonetheless, the substantial decline in survey index in 1998 and other qualifications remained, justifying advice substantially lower than the $F_{0.1}$ catch, perhaps a discounting by as much as 50%, until the effects on stock dynamics of the recent environmental and fishery changes are better understood.

These views could not be reconciled and it was decided that that the SSR would indicate that "it would be prudent not to allow catches to increase from recent levels".

4VWX+5Zc POLLOCK

Working Paper:

Neilson, J.D., P. Perley and C. Nelson. The 1998 assessment of pollock (*Pollachius virens*) in NAFO Divisions 4VWX and Subdivision 5Zc. WP 98/123

Rapporteur: Bob O'Boyle

The presentation highlights were:

- Review of tagging information.
- Assessment increasingly dependent on young pollock.
- Summary is considerably more pessimistic view due to:
  - Fishery concentrating in 4Xp and 4Xq.
  - Absence of old fish in DFO and RV surveys.
  - Declines in commercial CPUE and ITQ survey.
  - $F_{0.1}$ catch of 11.2 - 12.6 t projected for 1999 unadjusted for retrospective.
- More pessimism from industry in 1998 compared to 1997.
- 1997 quota of 15000t was not caught (reported landings 11,936t) due mostly to shortfalls in mobile gear; worse in 1998 so far.
- Assessments typically overestimating projected catch of old age groups.
- Don't use DFO Needler survey for abundance index due to year effects, but use it for age composition.
- Dramatic decline in ITQ survey catch rates during 1995 - 98.
- Used otter trawl CPUE as index of abundance.
- ADAPT
  - Strong residual patterns with higher observed CPUEs than predicted by model in recent period.
  - Removal of three years (94-96) did not change overall results.
  - Strong retrospective pattern.

The main points of discussion were:

The Fishery

- Tagging analyses were not weighted for fishing effort. However, the feeling is that the 4VW pollock generally move more westerly than pollock in 4X.

- The discussion focused on the reliability of the CPUE series in 4VW given the management restrictions. Summarized industry comments generally stated that fishing is better in western 4X-5Z than in eastern 4X-4VW. However, these comments need to be tempered due to the management restrictions in 4VW.

- However, the DFO survey indicates that there is little pollock in 4VW (except of young pollock), although the trends over time are not reliable. Counter point made that the DFO survey has never been good at catching large fish.

- Point made that when the resource is high, it is spread throughout the stock area. When it declines, the resource contracts into 4X-5Z. This has implications for the assessment model.

- Some agreement that since 1995 catch in 4X has become more and more concentrated in 4Xq and 4Xp.

- Comment was made that in commercial trips into 4Vn, 4Vsb and 4Vsc, young pollock can be caught.

- There was discussion on changes in the commercial weights at age. There was a slight decline from 1980s to 1994 and stability thereafter. However, with concentration in 4X, we should be seeing increases in weights at age. This tends to indicate that the fish are growing slower. Further investigation is required.

Resource Status

- Given that the ADAPT uses CPUE, how are the restrictive management measures, particularly in 4VW, taken into account? They are not explicitly. The CPUE accounts for only 171/0 of the overall variation. However, the CPUE trends appear consistent with observations on the resource.

- The 1995 ITQ CPUE may be an overestimate and that for 1998 may be an underestimate. Thus the downward trend may not be as dramatic as indicated. The survey should be very useful in the future.

- Point made that the standardization of the CPUE assumes that the trends in the various areas are parallel. This assumption was questioned. It was reported that an analysis using the ICCAT package allows for interactive terms. The trends generated were very similar. Thus the CPUE standardization as presented at the meeting was accepted.

- Concern with CPUE that the fleets may be changing their focus to the more abundant young fish over time. This would indicate that the CPUE series is overestimating the size of the resource.

- Why is this assessment so different from last years?

  - Two more years of poor CPUE
  - A retrospective pattern identified.

- What about reports of misreporting in 1997? Related to the hake fishery.

- What about movement? Too much of a change from 1997 to now.

- Perhaps CPUE is a nonlinear function of biomass. Current CPUE is overestimating the size of the population, as was the case last year.

- Question raised if we should be more qualitative about the status of this resource or should we undertake more quantitative analyses, particularly examining density dependent catchability changes. Suggestion to do the quantitative analysis first.

- Could the definition of MAIN SPECIES CAUGHT in the effort data be a problem?

- The problem is determining if it is an abundance or a distribution change. However, if CPUE is a nonlinear function of biomass, then CPUE can decline very rapidly as it 'catches up' with the decline in the resource.

- Environment was suggested as a possibility for explaining the inconsistency in the assessment from this to last year.

- The suggested change in the model might better fit the data but will not improve our outlook of the resource.

- A presentation was made confirming that landings have become concentrated in 4Xq during 1995-97 as compared to the 1985-94 period. Concentration of the resource into a small area of 4X is corroborated by the DFO summer survey information.

- Examination of the limited 4VsW sentinel survey data showed pollock inshore and concentrated along the 4X/4W boundary, with a reduction of these concentrations in 1997.

- An ADAPT was presented that incorporated a time trend in catchability. While this was not the formulation requested by the Subcommittee (testing of a relation between Q and biomass was intended), the analysis was possible within the time frame of this meeting. The results presented a much more pessimistic view of the resource with no decline of F since 1991 and a dramatic increase in F in 1998. It was presented that this was inconsistent with the observed trends in effort. However, it was countered

that if Q is a nonlinear function of biomass, then this is not a valid test of the model. Rather, the lack of a decline in F, as suggested by the observed effort data, is more consistent with the Q-adjusted model. As well, the DFO survey suggests very low abundance, again consistent with the Q-adjusted model. Finally, the concentration of the resource as observed in the survey and commercial data, is consistent with the Q-adjusted model. The Subcommittee felt that the observations were more consistent with the Q-adjusted model than with the original formulation. There was discussion on which model to present and how. It was pointed out that the original model adjusted for the retrospective pattern would provide similar results to the Q-adjusted model. Thus, in fact, the two models are saying similar things about the resource. Therefore, it was agreed that the original model would be adjusted for the retrospective pattern (the method as employed for silver hake was suggested for the adjustment) and the results used for the resource history as well as the projections.

Outlook

- There was discussion on why the current resource status was so different from that presented in 1997. It was noted that the addition of two more years of information was a critical part of this. In particular, it allowed confirmation of the presence of a retrospective pattern this is perhaps being caused by some trend in Q. It was noted that the current results are outside the bounds of the risk analysis of the 1997 assessment, underlying the fact that the previous assessment model was incorrect. Given the high variability in the analysis and the problems in the model, the value of presenting a risk analysis was questioned.

- The discussion focused on what can be done to ensure more consistent assessments in the future. One way is to not depend so fully on an analytical model as a basis of stock status. This is only one part of a larger information source, other parts of which include qualitative observations that cannot be easily incorporated into an analytical model.

- It was queried why acoustic surveys have not been considered. It was replied that a survey was attempted in the mid-1980s but the project was stopped due to funding problems. It was acknowledged that the quality of the input datasets was a major constraint on the production of a reliable assessment for pollock.

- It was agreed that the SSR would present the results of the original model adjusted for the retrospective pattern, describe supporting qualitative observations, and provide a short explanation of why the current and 1997 assessments are so different. A full explanation would be left to the research document and industry presentations.

- In the SSR, historical trends will be presented uncorrected and corrected for the retrospective pattern.

- Comment made that with the retrospective correction, the 1999 SSB would be in the range that an $F_{0.1}$ harvest would not be a prudent rebuilding strategy.

The recommendations for future work were:

- Investigate the 4VW sentinel surveys as source of pollock information.
- Investigate the integration of commercial CPUE across stock area using GIS methods as one approach to deriving an abundance index which accounts for shrinking stock distributions.
- Analyze commercial weights and lengths at age by area and season.
- Develop further the ADAPT model with CPUE as a nonlinear function of biomass.
- Develop an assessment paradigm that considers qualitative information along with the analytical models.

CUSK

Working Paper: Comeau, P. 4VWX Cusk

Rapporteur: Paul Fanning

- Because of concerns expressed by both industry and science, cusk has been added to the agenda for review in this RAP to determine if there is a reason to express a stronger need for caution than was made in the last review.
- The cusk catch has traditionally been a bycatch in the cod and haddock fisheries but recent catches have included more directed effort. Industry comments questioned the extent of directed effort, suggesting that it involves a very limited number of boats and trips. Industry also noted the historical catch of cusk in lobster traps, something which has declined considerably in recent years, but which is not reflected in the reported catch statistics.
- The research vessel series for cusk does not include any adjustment for the change in gear and vessels in 1982 and 1983 because of lack of cusk data from the comparative fishing work that was done. Thus the survey series must be interpreted carefully prior to 1983. The survey indication that the cusk abundance declined drastically after 1992 came later than the noticeable decline in the fishery which industry reported to have been in the early to mid 1980s. During early years, when areas have been depleted of cusk they have taken very long times to rebuild, fifteen years or more.
- There was little dispute that the cusk abundance had declined and that management action was required. The decline in the cusk abundance was sufficiently severe to be a potential candidate for IUCN endangered species designation, the appropriateness of existing criteria notwithstanding.

- Elimination of any directed fishery for cusk and control of bycatch was agreed to be feasible. It was also pointed out that some catch of cusk is nearly unavoidable in groundfish fisheries in parts of 4X and that excessively restrictive bycatch limits would simply provoke discarding with very high mortality likely for cusk returned to the water. The need for a more innovative set of management tools was identified and closures of areas discussed as one such approach. Traditional fisheries closures were seen as of limited usefulness by themselves. They need to be carefully planned and integrated into a broader set of marine protected areas designed to protect both individual species, their habitat and their ecological requirements.

No new analyses were requested to be done during the meeting. The following recommendation for future work was made:

- Investigate the utility of "no take" closed areas as a management tool to aid in the rebuilding of cusk.

4VWX+5Zc WHITE HAKE

Working Paper:

Fowler, M., K. Zwanenburg, P. Fanning, P. Comeau, G. Black, S. Campana, W. Stobo, K. Frank, M. Sinclair, P. Hurley, R. Branton, J. Simon, R. Mohn, M. Showell and K. Drinkwater. 4VWX and 5 white hake 1998 stock assessment. WP 98/126

Rapporteur: Kees Zwanenburg

The main points of discussion were:

Stock Structure

- Examination of survey distributional information (summer) for this resource indicated that concentrations in NAFO Division 4V should be considered separately from those in 4W and eastern 4X, which in turn should be considered independent of those in the Bay of Fundy, and western 4X. The latter concentration appears to be contiguous with the Gulf of Maine/Georges Bank stock.

The Fishery

- The present analyses focused primarily on the Bay of Fundy/Western 4X concentration.

- The first TAC was established in 1996 and has been exceeded every year since.

- Sampling of the commercial landings was sporadic before 1993.

- Commercial catch rates have declined since 1990 as indicated by an index fleet consisting of vessels which have directed for white hake in at least 5 consecutive years.

- These commercial catch rates are consistent with the results of the summer research vessel survey results.

- Size composition in the commercial catches indicates a loss of the larger fish.

Surveys

- The 1998 summer survey results indicate that the 1998 weights per tow value is the lowest since the 1970s, the survey also shows a decline in the numbers of white hake caught since 1992 and that the 1998 value is the lowest since 1992. There is no evidence of any recruitment pulses in recent years.

- Trends in total mortality (Z) have increased steadily since 1980 with some evidence of a decline since 1996. This is consistent with the declining biomass observed in the results of the summer research vessel surveys.

- As was the case in the fishery, larger fish have become less abundant. This is also evidenced by the decline in the mean weight of an individual hake caught in the survey, which has declined since the early 1980s. The absence of significant numbers of recruits over this time period precludes the possibility that this decline is due to recruitment.

- It was requested that during the meeting the time series from the US surveys be updated to include the most recent information.

General Discussion

- The management plan for white hake has been altered every year since the first fixed TAC was established in 1996. This has resulted in many changes in fishing strategies for white hake.

- There are indications of pollock being reported as white hake in 1996. A rough estimate indicates that this could have accounted for as much as 20% of the reported white hake landings.

- Some very high landings (by trip?) in 1996 resulted in the establishment of trip limits (10,000 lbs.) in 1997.

- Fish were very difficult to catch in 1998.

- In 1998, the landings are largely from bycatch. The proportion of directed landings have declined in recent years with the greatest decline in 1998 (<40%). The

proportion of directed versus bycatch landings appears to be a complex issue largely dependent on community level allocation schemes.

- The issue of gillnet discarding was discussed. It was indicated that this is a concern where nets are set and cannot be tended due to weather conditions. The concern is that this is adding undocumented mortality.

- Estimation of mortality - it was concluded that using the present estimates of the Von Bertalanfy growth model resulted in total mortality estimates of about 1.0. It is recommended that the most recently updated estimates of these parameters be used to recalculate these Z estimates. The group did not consider that these new parameters would significantly alter the estimates of Z.

- It was observed that white hake had been extirpated from some areas in the past (western PEI for example). The comment was made that we do not want to follow the landings down to nothing but that a rebuilding strategy is in order. Such a strategy would be to fish well below $F_{0.1}$. Present estimates of F (assuming M=0.2) would be in the order of 0.8.

- There was some discussion of efficacy or desirability of establishing closed areas to provide refugia for white hake. There were concerns that these closed areas could result in the displacement of effort to other areas and stocks.

- The SSR should reflect the idea that the fishery in 1999 be kept to by-catches only with the lowest possible landings. There should be an option to close the area if landings become excessive. It should also indicate that the present management plans are not effective at protecting white hake.

The following recommendations for future work were made:

- It is recommended that the affiliation of the white hake concentrations which occur in 4V (Laurentian Channel) to those occurring in the Gulf of St. Lawrence, should be investigated and reported on during the next assessment of this resource.

- It is recommended that the mean weights of individual fish in the RV catch be calculated for the years 1995 through 1998.

4VsW WINTER SKATE

Working Paper:

Simon, J.E. and K.T. Frank. Assessment of winter skate fishery in Division 4VsW. WP 98/128

Rapporteur: Ghislain Chouinard

The main points of the presentation were:

- The stock was last reviewed 2 years ago. A large fishery by foreign fleets existed prior to the declaration of the 200 mile limit. Subsequently, removals from the stock were primarily from by-catch in groundfish fisheries. Winter skate have been the subject of an experimental directed fishery since 1994. Landings were over 2,000 t in 1994 but have been near the TAC of 1200 t in recent years. The fishery has been concentrated in two areas: the Eastern Shoals (4Vs) and on western Sable Island Bank (4W). Catch rates in the experimental fishery have remained stable, but a decline in the number of larger fish (>90 cm) is apparent in the last few years. The research vessel survey index indicate a monotonic decline in weight per tow for this species over the period of 1971 - 1998. In recent years, the abundance index has fluctuated at a low level. The 1998 survey weight per tow is the lowest in the time series. However, strata in the slope area exhibited an increase in the index in recent years, possibly suggesting a shift in distribution. Maturity examination conducted in recent years indicate that length at 50% maturity for females is around 75 cm. Calculation of total mortality using catch curves with two different age models both suggest a doubling in total mortality between 1995 and 1998.

The main points made during the discussion were:

- It was clarified that, prior to the experimental fishery, skates were not identified to species in the statistics. Estimates of removals were calculated by using by-catch rates from the observer data.

- An industry representative indicated that the decline in larger skates may be due to changes in water temperatures. It was indicated that vessels participating in the fishery can only fish to depths of 150-170 fathoms. It was suggested that larger skates moved to deeper waters. However, observations from sets conducted in deep water in the redfish fishery in the late 1980s indicate that winter skates were not present in waters deeper than 200 fathoms at that time.

- It was first suggested that the decline in large fish appears to correspond to the decline in water temperature. However, it was subsequently pointed out that the timing in reduction of the catch of large skates does not correspond to the change in water temperatures in the Eastern Shoals area. An examination of water temperature preference was suggested.

- Survey data suggest a decline in biomass over the time series 1970-1998 with a possible shift in distribution to slope strata in recent years.

- The mesh size has been increased to 255 mm in 1995 and >300 mm in 1996 as a conservation measure and to reduce by-catch of other groundfish species. Industry has been endorsing conservation measures and would like the fishery to be sustainable.

- Industry indicated that the reduced fishing effort during 1997-1998 is caused by poorer markets.

- The distribution of the species suggests that 4VsW constitutes a distinct stock.

- Survey biomass estimate in 1998 is around 860t. It was suggested that catchability of this species to the survey may be in the range of 20% which would imply a biomass of around 4300t.

- It was pointed out that the term 'experimental' hardly applies to this fishery.

- It was suggested that the fishery could be restricted to deeper waters (> 150 fathoms) in 1999. This would help confirm whether large fish have moved to deep waters. Industry indicated that this was not possible because the bottom was not suitable in deeper waters. They indicated that this would essentially shut down the fishery.

- Many of the Working Group members were concerned that the stock is showing some serious signs of over-exploitation (reduced size-range, contracted range, high Z) and that the experimental fishery should either be closed or reduced to a very low level. There was no consensus on this point. Although there seemed to be general agreement that catches need to be reduced to ensure conservation, there was no agreement on what the level of catches should be. 600 t was mentioned as a possible level.

No new analyses were requested to be done during the meeting. The following recommendation was made for future work:

- Estimation of winter skate temperature preference may help understand the potential impact of temperature on the distribution of the species and the apparent change in distribution in recent years.

HARBOUR PORPOISE

Rapporteur: Tom Hurlbut

The key points of the presentation and discussions were:

- The presentation described efforts to quantify and reduce the by-catch of harbour porpoise in demersal gillnet fisheries in the Bay of Fundy, Gulf of Maine and U.S. mid-Atlantic coast. Concern exists that the combined mortality levels by demersal gillnetters in Canada and the U.S. are high enough to be considered unsafe for the long-term sustainability of this transboundary population.

Summary points included:

- Annual by-catch estimates have been made by the U.S. since 1990 for the Gulf of Maine, and since 1995 for the mid-Atlantic coast, and by Canada for the Bay of Fundy since 1993.
- By-catch estimates for the Gulf of Maine range from a high of 2,900 porpoise in 1990 to 1,200 in 1996.
- By-catch estimates for the Bay of Fundy range from a high of 424 porpoise in 1993 to a low of 15 in 1998.
- In 1996, the Gulf of Maine Harbour Porpoise Take Reduction Team established the target of zero moralities in New England gillnet fisheries for April 30, 2001.
- In Canada, a Harbour Porpoise Conservation Strategy for the Bay of Fundy was established in 1996 limiting the annual Canadian by-catch to 110 porpoise.
- Time-area closures were instituted for gillnet fisheries in the U.S. in 1994 to reduce porpoise moralities.
- In 1995, acoustic pingers were implemented in experimental U.S. gillnet fisheries to reduce porpoise by-catch.
- Field tests with acoustic pingers began in Canada in 1996.
- Pingers appear to be an effective method for reducing harbour porpoise entanglement in demersal gillnets without restricting fishing effort (properly deployed pingers can reduce porpoise by-catch rates by up to 77%).
- In 1998, limited field tests with "acoustically noticeable" gillnets were conducted in the Bay of Fundy but the results are considered inconclusive.
- The reduction in Canadian harbour porpoise by-catch since 1993 is likely due to "within season" fishery closures, low groundfish abundance, fewer vessels fishing, testing of pingers and reduced porpoise abundance in the Bay of Fundy.

No new analyses were requested during the meeting, and there were no recommendations made for future work.

SPINY DOGFISH IN NAFO SUBAREAS 2-6

Rapporteur: Ghislain Chouinard

- An assessment of spiny dogfish in NAFO subareas 2-6 was not requested but an SSR update was tabled.

- There was a brief discussion as to why a formal stock assessment was not requested given the recent, sharp declines in Canadian and U.S. survey abundance indices.

- It was noted that the schedule for the fall RAP meeting was prepared before the results of the latest survey of the southern Gulf were available. It was also noted that a comprehensive assessment of spiny dogfish in NAFO subareas 2-6 was completed by the U.S. National Marine Fisheries Service in Dec. 1997.

The SSR update was reviewed and several editorial changes were suggested.

- It was recommended that the Resource Status section include a figure showing the U.S. spring survey abundance index and that the Outlook section combine the outlook from the last Stock Status Report (DFO, 1996), as well as, a current outlook reflecting the results of the latest U.S. N.M.F.S. assessment and the most recent Canadian and U.S. surveys.

CONCLUDING DISCUSSION

During the concluding discussion the major focus was on the need for an overview presentation of the ecosystem scale changes that have been occurring during the past decade. It was agreed that the first step was to prepare a summary of the stocks that had been reviewed during the meeting. This summary would be presented to FRCC and the fishing industry prior to the individual SSRs. Subsequently, a more detailed analysis at the ecosystem level will be conducted. This will require work planning and peer review at special RAP meetings separate from the standard meetings for stock assessments.

It was pointed out that the schedule for the meeting had facilitated discussion of issues and provided enough time to conduct the reviews. The Chair thanked the participants for their active participation during a difficult meeting.

Appendix 1. List of Participants.

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Zwanenburg, Kees	MFD/Dartmouth, NS	(902)426-3310	(902)426-1506	zwanenburgk@mar.dfo-mpo.gc.ca

Appendix 2. Invitation Letter

Marine Fish Division
Maritimes Region
Science Branch
(TEL: 902 426-4890)
(FAX: 902 426-1506)
(E-mail: sinclairm@dfo-mpo.gc.ca)

Participant (See attached distribution list)

15 September 1998

Dear :

During 26-30 October, 1998, we will be convening a meeting of the Marine Fisheries Subcommittee of RAP to peer review groundfish resources of the Scotia-Fundy Area of the Maritimes Region.

Full assessments will be presented for:

- 4X cod
- 4X haddock
- 4VWX silver hake
- 4VWX, 5Ze pollock
- 4VW, 4X+5Ze white hake
- 4VWX cusk
- 4VsW skate

Updates will be tabled for:

- 4Vn cod
- 4VsW cod
- 4TVW haddock
- 4VW plaice/yellowtail flounder
- 4X winter flounder/yellowtail/plaice
- 4VWX witch
- 4VWX, 5Ze Atlantic halibut
- 4VWX monkfish
- 4VWX wolffish
- 2-6 spiny dogfish

Also, an update of the oceanographic conditions will be provided. You are invited to this meeting as an external reviewer. We hope to send out the documents to you prior to the meeting. It will be held at the Holiday Inn Harbourview, 99 Wyse Road (near MacDonald Bridge) in Dartmouth and will start at 10:00 am on Monday, 26 October. The draft agenda is attached. I would appreciate it if you could confirm your attendance with Wanda Farrell (902-426-4890).

I look forward to an interesting meeting.

Yours sincerely,

Michael Sinclair
Manager
Marine Fish Division

Attachment

cc:
R. O'Boyle
D. Rivard
D. Geddes
K. Frank
G. Chouinard
J. Hansen
G. Peacock
P. Smith
J. Rice
FRCC
M. Yeadon
J. Neilson
J. Loch
C. Annand
F. Page

MMS:wmf

Appendix 3. Agenda.

Agenda
Holiday Inn Harbourview
99 Wyse Road (Near MacDonald Bridge)
Dartmouth, Nova Scotia

Monday, 26 October	**Authors**	**Rapporteur:**
10:00 – 11:00 Review of Oceanographic conditions of Scotia-Fundy Area		Doug Swain
11:00 – 12:30 4X Haddock	Peter Hurley	Steve Campana
13:30 – 15:30 4X Haddock		
16:00 – 19:00 4X Cod	Don Clark	Ken Frank
Tuesday, 27 October		
09:00 – 12:30 4VWX Silver hake	Mark Showell	Ralph Halliday
13:30 – 17:00 4VWX+5Zc Pollock	John Neilson	Bob O'Boyle
17:00 – 19:00 Cusk	Kees Zwanenburg	Paul Fanning
Wednesday, 28 October		
09:00 - 12:30 White hake	Mark Fowler	Kees Zwanenburg
13:30 - 17:00 Skate	Jim Simon and Ken Frank	Ghislain Chouinard
17:00 - 18:00 Harbour Porpoise		Tom Hurlbut
Thursday, 29 October		
Reruns, SSRs and updates		
Friday, 30 October		
SSRs, proceedings and research recommendations		

Appendix 4. List of Documents Tabled.

Drinkwater, K.F., D.B. Mountain, and A. Herman. Recent changes in the hydrography of the Scotian Shelf and Gulf of Maine - A return to conditions of the 1960s? WP 98/114

Losier, R., F. Page, P. McCurdy, M. Ringuette, and J. McRuer. 1997. Overview of 1998 hydrographic sampling effort and near-bottom water temperature and salinity conditions during the Canadian research vessel groundfish summer surveys conducted on the Scotian Shelf and the Bay of Fundy (4VWX). WP 98/116

Losier, R., F. Page, P. McCurdy, M. Ringuette, and J. McRuer. 1998. Overview of 1998 hydrographic sampling effort and near-bottom water temperature and salinity conditions during the Canadian research vessel groundfish summer surveys conducted on the Scotian Shelf and the Bay of Fundy (4VWX). WP 98/117

Hurley, P.C.F., G.A.P. Black, P.A. Comeau, and R.K. Mohn. Assessment of 4X haddock in 1997 and the first half of 1998. WP 98/121

Van Eeckhaute, L. Update of haddock in 4Xs (New Brunswick side of Bay of Fundy). WP 98/122

Clark, D. Assessment of cod in Division 4X in 1998. WP 98/120

Branton, R. Effects of Scotian Shelf small mesh gear fishery regulations on the catch rate of silver hake and bycatch rates of cod, haddock and pollock in the period 1983-98. WP 98/125

Showell, M.A. *et al.* Assessment of the Scotian Shelf silver hake population in 1997, with projection of yield to 1999. WP 98/124

Neilson, J.D., P. Perley, and C. Nelson. The 1998 assessment of pollock (*Pollachius virens*) in NAFO Divisions 4VWX and Subdivision 5Zc. WP 98/123

Comeau, P.A. 4VWX Cusk WP 98/127

Fowler, M., K. Zwanenburg, P. Fanning, P. Comeau, G. Black, S. Campana, W. Stobo, K. Frank, M. Sinclair, P. Hurley, R. Branton, J. Simon, R. Mohn, M. Showell, and K. Drinkwater. 4VWX and 5 white hake 1998 stock assessment. WP 98/126

Simon, J.E., and K.T. Frank. Assessment of winter skate fishery in Division 4VsW. WP 98/128

Appendix 5. List of Recommendations.

Environmental Overview: Scotian Shelf and Bay of Fundy

- Develop a rapid method of incorporating temperature and salinity data collected during industry surveys into the standard databases used to evaluate environmental patterns in the Scotian Shelf/Gulf of Maine area.

4X Cod

- Conduct an examination of all available seasonal surveys to look for characteristic patterns of distribution that might be indicative of population structure and evaluate the degree to which it has changed over time.

- Consider using a GIS-based approach to developing an abundance index for cod from the ITQ survey.

- Calculate weights at age from the research vessel surveys.

4VWX Silver Hake

- It was recommended that the relationship of basin and shelf edge populations be further investigated, e.g., by looking for differences in length and weight at age and by mapping distributions by life history stage and age group.

- It was recommended that changes in population parameters for all Scotian Shelf stocks should be examined in relation to possible causative factors, and the effects of these changes on productive capacity should be described.

4VWX+5ZC Pollock

- Investigate the 4VW sentinel surveys as source of pollock information.

- Investigate the integration of commercial CPUE across stock area using GIS methods as one approach to deriving an abundance index which accounts for shrinking stock distributions.

- Analyze commercial weights and lengths at age by area and season.

- Develop further the ADAPT model with CPUE as a nonlinear function of biomass.

- Develop an assessment paradigm that considers qualitative information along with the analytical models.

Cusk

- Investigate the utility of "no take" closed areas as a management tool to aid in the rebuilding of cusk.

4VWX+5ZC White Hake

- It is recommended that the affiliation of the white hake concentrations which occur in 4V (Laurentian Channel) to those occurring in the Gulf of St. Lawrence, should be investigated and reported on during the next assessment of this resource.

- It is recommended that the mean weights of and individual in the RV catch be calculated for the years 1995 through 1998.

4VsW Skate

- Estimation of winter skate temperature preference may help understand the potential impact of temperature on the distribution of the species and the apparent change in distribution in recent years.

Recommendations from the Stock Assessment Working Group

4X Haddock

- While stock dynamics may well have differed prior to the 1960s, post 1970 dynamics indicate that haddock in 4Xs and 5Y probably represent the extremes of the 4X haddock distributional range, as is the case for 4X cod. Therefore, the WG recommends that the assessment unit for 4X haddock be expanded so as to include 4Xs and 5Y.

- The recent addition of new strata to the ITQ survey has complicated interpretation of the annual abundance index. Therefore the WG recommends that A. Sinclair's RV multiplicative model be used to calculate the annual ITQ index, thereby correcting for any changes in strata surveyed.

- The ITQ survey design considers consistency in the vessels used to be important. However, vessel changes in future may be unavoidable. The WG recommends that vessel intercalibration or other options be considered before any vessel changes occur.

- The ITQ surveys a large inshore area which is currently unsurveyed by the RV survey, and for which an age-length key is not available. Pending development of an appropriate age-length key, the key from the Bay of Fundy RV will be applied. The WG recommends that an appropriate age-length key be developed for the inshore, untrawled region of the ITQ survey.

4VWX Silver Hake

- The WG recommends that a reference collection for silver hake be prepared so as to insure long-term ageing accuracy, either through development of an otolith sectioning protocol, or image digitization of glycerine-soaked otoliths.

- The WG recommends that fishing plans for the domestic silver hake fishery include a minimum of 10% observer coverage so as to provide acceptable scientific data for the domestic silver hake fishery.

- Problems with the interpretation of Stratis' version of ADAPT (based on unfamiliarity and the absence of standard diagnostics) highlighted the need for a user-friendly, generic ADAPT model for general use. A similar need was expressed by the WG last year. The WG reiterates its request for a generic, user-friendly version of ADAPT for use on the PC.

4VWX+5Zc White Hake

- Based on existing information, it appears likely that at least some red and white hake are being misidentified on RV surveys as to species. To determine the extent of the misidentification problem, the WG recommends that appropriate samples of hake be collected, identified and retained at sea as part of regularly-scheduled RV surveys in both the eastern and western Scotian Shelf, and that their identifications subsequently be confirmed by the ARC.

- Fish mortality resulting from untended gillnet catches while gillnetters return to port to offload catches has the potential to compromise fish conservation efforts. The WG strongly recommends that appropriate action be taken to either enforce the 40 net per boat limitation, or otherwise stop the practice of leaving gillnets untended.

4VsW Winter Skate

- The WG recommends that the utility of the 1996-98 industry survey as an abundance index for winter skate be evaluated, and if found wanting, that the survey be redesigned.

Appendix 6. Minutes of meetings of Marine Fish Division (BIO) Stock Assessment Working Group.

Chair: S. Campana

Members:

G. Black	K. Drinkwater	P. Fanning
R. Branton	K. Frank	P. Hurley
P. Comeau	M. Showell	R. Mohn
J. Simon	K. Zwanenburg	M. Fowler
W. Stobo		

The *Stock Assessment Working Group* met September 15th and 24th, October 2nd, 6th, 8th, 13th, 16th, 20th and 22nd to develop, evaluate and review the 1998 stock assessments and draft SSRs for 4X haddock, 4VWX silver hake, 4VWX+5Zc white hake, 4VsW winter skate, and 4VWX cusk. The following represents a brief summary of the issues considered, major findings and recommendations for further research.

4X Haddock (Hurley)

Stock Structure

- include 4Xs in assessment, or provide rationale why it shouldn't be
  - management unit is all 4X+5Y; however 4Xs is not included in stock assessment, either here or in US;
  - both current and historical tagging studies show relatively few returns from 4Xs, but was also relatively little effort (~1%) in 4Xs compared to remainder of 4X;
  - comparison of length frequencies between 4Xs and remainder of Bay of Fundy was inconclusive;
  - ECNSAP suggests that there is no Gulf of Maine stock; rather 4Xs appears to be more a continuum of Browns-Bay of Fundy;
  - location of commercial fishing in 1990s shows that most of the 4Xs fishing is in the middle of the Bay of Fundy, rather than along NB coast; and,
  - comments from port sampler indicate that high catches in 5Y from 1980s were actually misreported 4X.

While stock dynamics may well have differed prior to the 1960s, post 1970 dynamics indicate that haddock in 4Xs and 5Y probably represent the extremes of the 4X haddock distributional range, as is the case for 4X cod. Therefore, the WG recommends that the assessment unit for 4X haddock be expanded so as to include 4Xs and 5Y.

Catch

- Landings

- Discard estimates
  - port sampler reports small amounts of highgrading, consistent with discarding levels of recent years.

- Small mesh gear bycatch

- Comparisons among age readers
  - some bias for age 7+ in RV; commercial ages don't show as much bias

- Comparison of new 1985-87 ages with those estimated in last year's assessment
  - changed catch at age by up to 12% for some ages and years (e.g.- ages 5 and 6 in 1985); and,
  - revised ages provide much better retrospective fit, and much higher Fs during mid 1980s, but does not affect recent pattern

July RV survey

- Aundance trends, distribution
  - numbers of fish < 43 cm still above average, but mature biomass is well below long-term average;
  - many of young fish are on Browns, not in Bay of Fundy; distribution of larger fish is opposite; this is reversed from historic distribution; and,
  - 1993 and 1994 year-classes no longer nearly as large as were believed in past assessments.

- Age composition, size at age, condition trends
  - size at age increased, then decreased, since 1985; has decreased in recent years in both Bay of Fundy and offshore; and,
  - condition factor has been relatively constant since 1993, but is still well below long term mean.

- Zs; need to compare with Fs from ADAPT
  - Zs of ages 7-9 has been high since early 1990s (about 0.9); and,
  - Zs of younger ages have had no long-term trend, although have increased in last few years.

- Recruitment index based on q-corrected age 2 and 3
  - same general pattern as that from VPA.

ITQ survey

- 1998 distribution
  - consistent with previous years.

- Annual abundance index
  - slight but non-significant decline since 1996, at least in 1998.

- Compare index based on strata fished consistently by same vessel versus index using all strata (including controversial strata) to determine if trend is similar.

- Calculate minimum trawlable biomass and fishable biomass in inshore region and compare with that offshore from RV.

- Compare trawlable biomass on year-by-year basis using potential maps, ACON and stratified estimates; need to compare potential map biomass with and without additional, recent fishing locations in eastern 4X
  - potential maps result in approx. 80,000 mt (72,000-87,000 over 4 years) in all of surveyed 4X, 20% of which is in inshore region; this compares favourably with percentage of area in 4X which is unsurveyed by RV (=20%);
  - shows slight but consistent decline since 1996;
  - trend from RV is very similar, although magnitudes differ;
  - biomass estimates from stratified mean values range from 147,000-110,000 mt, with lowest value in 1998, as was seen with potential map trends; however biomass based on stratified means is unduly influenced by inshore estimates (which extrapolate over large unsurveyed areas); therefore potential map estimates are considered more reliable, and will be used as basis for ITQ index in ADAPT; and,
  - volume estimates from ACON range from 67,000-82,000 mt, but area included is different than that used with potential maps; since the ACON maps miss different amounts of 4X each year, estimate based on potential maps is probably more reliable.

The recent addition of new strata to the ITQ survey has complicated interpretation of the annual abundance index. Therefore the WG recommends that A. Sinclair's RV multiplicative model be used to calculate the annual ITQ index, thereby correcting for any changes in strata surveyed.

The ITQ survey design considers consistency in the vessels used to be important. However, vessel changes in future may be unavoidable. The WG recommends that vessel intercalibration or other options be considered before any vessel changes occur.

ADAPT

- Incorporate ITQ index into ADAPT; use both stratified mean number per tow and potential map biomass index; use both inshore and offshore ITQ index
  - can apply RV age length key to ITQ survey (since RV and ITQ are done at same time of year) to calculate age-structured index, albeit with some caveats;
  - ADAPT with and without ITQ shows relatively little difference;
  - run using potential map biomass estimate as basis for ITQ survey is also very similar; and

- given that ITQ as abundance index appears robust, rationale for including ITQ in ADAPT appears sounds.

The ITQ surveys a large inshore area which is currently unsurveyed by the RV survey, and for which an age-length key is not available. Pending development of an appropriate age-length key, the key from the Bay of Fundy RV will be applied. The WG recommends that an appropriate age-length key be developed for the inshore, untrawled region of the ITQ survey.

- Compare current ADAPT with that of last year
  - big change is effect of 1985-87 catch at age;
  - inclusion of 4Xs and 5Y into catch at age had minimal effect on ADAPT; and,
  - serious retrospective problem in recent years, presumably associated with strong recent year-classes; will correct using Gompertz fit between contemporaneous and converged VPA estimates; however, correction is only necessary for 1993 and 1994 year-classes, since those are the only ones which are not fit well.

- Present population trends showing both Gompertz-corrected and uncorrected values.

- **4VWX Silver Hake (Showell)**

Stock Structure

- Distribution from ECNSAP to determine if it is a suggestion of discontinuity between Scotian Shelf and Georges/4X silver hake
  - suggests that 4VW separate from 4X5YZ.

- Distribution from ECNSAP with American data alone to see if discontinuity between Browns and Georges is real
  - was consistent with original observation of discontinuity.

- Compare synchrony of US RV trend with that of 4X and Scotian Shelf to determine if it is evidence of US stock spilling out onto the Shelf
  - significant relationship between US RV and Bay of Fundy, but not with Scotian Shelf.

- Check MARMAP data and SSIP for evidence of spawning locations
  - summer egg distributions from SSIP show strong evidence of spawning on central Scotian Shelf.

- Compare age or length composition between 4VW and 4X-Gulf of Maine to see if it is consistent with stock separation.
  - relative abundance of age 1 fish was very high in Bay of Fundy, but quite low on Scotian Shelf; this could mean that Bay of Fundy is nursery area, and that larger fish move onto Scotian Shelf after age 1.

Available information suggests that the Bay of Fundy silver hake are more closely associated with those of the Gulf of Maine than those of the Scotian Shelf, although the possibility that the former is a nursery area for the latter could not be rejected. Pending new information, the WG concluded that only the Scotian Shelf strata would be used to calibrate the ADAPT (excluding the Bay of Fundy). However, ADAPT runs with and without the Bay of Fundy strata would both be tabled.

Catch

- Quality control of age readers
  - no bias this year compared to last.

Routine ageing for silver hake is based on glycerine-soaked otoliths, which tend to become unreadable after one or more years of storage. As a result, there is no reference otolith collection for silver hake as there is for other groundfish stocks, and thus no means of ensuring long-term ageing accuracy.

The WG recommends that a reference collection for silver hake be prepared so as to insure long-term ageing accuracy, either through development of an otolith sectioning protocol, or image digitization of glycerine-soaked otoliths.

- CPUE of foreign trawlers
  - increased from 1979 to 1989, then declined sharply to present; decline since 1992 has been more gradual; and,
  - 1994+ CPUE has been increased by 5% to account for introduction of separator grate.

- Assess utility of CPUE of Canadian trawlers as abundance index
  - both observer and logbook data show relative stability since 1996, although have increased since 1995; effect of learning curve is undoubtedly present, but magnitude unknown; and,
  - since learning curve present, and given that time series is still very short, is premature to use Canadian CPUE as abundance index.

There was very little coverage of the domestic silver hake fishery by IOP in 1997, making it difficult to compare the catch of this sector with that of the foreign fleet. IOP coverage was not much better in 1998. **The WG recommends that fishing plans for the domestic silver hake fishery include a minimum of 10% observer coverage so as to provide acceptable scientific data for the domestic silver hake fishery.**

- 1997 sampling of domestic fishery was poor, although the plant collected unsexed length frequencies. To determine if the sex ratio from previous years was comparable to that of 1997, examine sex ratio by month in each of 1995 and 1996 from domestic fishery and determine if it can be safely applied to 1997 catch; if yes, use age-length key of 1997 foreign fishery to pro-rate 1997 domestic catch

- inshore (domestic) caught smaller fish than offshore (foreign) in both 1996 and 1997; RV showed similar pattern; and,
- sex ratio at length became increasingly female beyond about 25 cm in both 1995 and 1996, although proportions male differed systematically between years; used smoothed mean proportion at length to pro-rate unsexed 1997 length frequencies.

- Catch
  - 1998 catch was evenly split between foreign and domestic; has been dominated by foreign until now; and,
  - no appreciable change in weight at age over past 5 years, although has declined by 20-50% since 1979; same has been observed in RV; no apparent explanation for decline other than continuous fishing effort; length at age has declined in concert with condition factor; stock biomass has also declined since 1979.

July RV survey

- Abundance trends
  - has declined substantially since early 1980s;
  - exclusion of Bay of Fundy strata made relatively little difference to index; and,
  - since conversion from *A.T. Cameron* was 2.3X, post 1981 index is internally consistent.

- Age composition, size at age, condition trends
  - cohort tracking of both RV and CPUE did not show obvious tracking; in part, may be due to relative scarcity of poor year-classes;
  - correlations along year-classes relatively poor; only good between ages 1-2 in RV, but slightly better in foreign CPUE; and,
  - could reflect errors in ageing, or a stock separated by age group, or fishery effects.

- Zs
  - Zs of ages 3-5 have remained relatively constant at about 1.1 since 1985, although has increased slightly to 1.3 in last 3 years; assuming M=0.4 and given $F_{0.1}$=0.7, suggests that stock has been fished at $F_{0.1}$ since mid 1980s'; and,
  - Zs of older and younger ages were less; that for ages 1-2 has declined since 1989.

- Recruitment index based on age 1.

- Distribution by year in relation to temperature
  - good relationship overall, whereby silver hake associated with warmer temperatures.

- Comparison of temperatures in silver hake box with commercial catch rates
  - was broad correspondence between temperature and foreign CPUE over period between 1977-1998; however, was unclear if temperature was correlated with long-term recruitment or short-term catchability.

0-group Survey

- Annual abundance index
  - 1996 and 1997 young of the year (YOY) values very high; 1996 age 1 from RV also high, but 1997 age 1 somewhat lower; and,
  - therefore 1996 year-class may be above average, but 1997 year-class is unknown.

ADAPT and Projections

- Use XSPA to decide which (if any) of the indices should be included in the calibration.

- Reexamine need for dome-shaped PR.

- Use 2 RV indices: 1 with only post- *A.T. Cameron* index (1982+), and the other with 1979+
  - residuals show non-random patterning in 1990s;
  - ADAPT suggests that recent years show exponential increase in abundance, despite stability or downward trend in abundance indices;
  - given poor cohort tracking for older ages (suggesting possible ageing errors), and relative absence of age 5+ fish in catch at age, and given uncertain conversion factor between *A.T. Cameron* and *Alfred Needler* in RV series, will truncate calibration block to ages 1-4 and 1983+; will run with both Stratis' software and ACON; and,
  - recent increase probably being driven by introduction of Canadian catch at age in 1996+, which is dominated by younger fish than those normally caught offshore by foreign fleet (age 2); therefore need to exclude this from ADAPT.

Problems with the interpretation of Stratis' version of ADAPT (based on unfamiliarity and the absence of standard diagnostics) highlighted the need for a user-friendly, generic ADAPT model for general use. A similar need was expressed by the WG last year. The WG reiterates its request for a generic, user-friendly version of ADAPT for use on the PC.

4VWX+5Zc White Hake (Fowler)

Species identification

- Compare relative abundance of red hake and white hake from RV survey in which one watch used gill rakers to confirm species ID, while other watch did not
  - proportions were 47% Vs 37%; therefore may not be large misidentification problem, although may still affect small hake;
  - cannot trust ID of small hake; therefore cannot develop recruitment index; however, ID of large white hake in commercial catch is probably correct; and,
  - compared length frequencies of red and white hake in above RV cruise by watch, but results were inconclusive.

- Overall RV distribution of red and white hake using same scale
  - white hake dominant in Gulf of Maine and Laurentian Channel, but red and white hake present at similar densities on central Scotian Shelf; and,
  - absence of red hake in 1970s, followed by sudden appearance in 1980s, suggests that red hake misidentified as white hake prior to 1977 and perhaps 1981.

- Instructions in 1981 RV manual for differentiating hakes
  - uses jaw, dorsal fin, gillrakers.

- Compare length frequencies of white and red hake from IOP measurements of silver hake bycatch
  - length modes of red and white hake are identical; have they been identified correctly?; and,
  - tried to compare length frequencies of red and white hake in silver hake bycatch (IOP) between 4V and 4X, but were no appreciable bycatches in 4V IOP silver hake fishery.

Based on existing information, it appears likely that at least some red and white hake are being misidentified on RV surveys as to species. To determine the extent of the misidentification problem, the WG recommends that appropriate samples of hake be collected, identified and retained at sea as part of regularly-scheduled RV surveys in both the eastern and western Scotian Shelf, and that their identifications subsequently be confirmed by the ARC.

Stock Structure

- Distribution from ECNSAP
  - suggests that Laurentian Channel is contiguous with 4T stock; however, is unclear if central Scotian Shelf is associated with it or 4X/5Z.

- Table summary of stock structure info; key graphics
  - stock structure info was inconclusive; will table landings and abundance indices by NAFO division for administrative convenience, pending further scientific information.

- Tagging data
  - virtually all white hake tagged in Gulf were recovered in Gulf, but probably was no fishery outside of Gulf; therefore results inconclusive.

- Comparison of 4T RV survey distribution with that of 4VW summer RV.

- Spawning locations from SSIP
  - no eggs or larvae identified; juveniles found in reasonable numbers on central Scotian Shelf; is possible that originated from Shelf edge spawning; however, results inconclusive; and,

- unspecified Urophycis spp. also abundant on central Shelf.

- Stock structure document from previous WG
  - document did not provide conclusive evidence of 3-4 white hake stocks.

Catch

- Landings and length composition
  - port sampler reports increased effort in recent years, particularly by gillnets; and,
  - many gillnetters set 40 unidentified nets while returning to port with catch from additional 40 nets, hauling nets 3-4 days later after everything has died.

Fish mortality resulting from untended gillnet catches while gillnetters return to port to offload catches has the potential to compromise fish conservation efforts. The WG strongly recommends that appropriate action be taken to either enforce the 40 net per boat limitation, or otherwise stop the practice of leaving gillnets untended.
  - landings have declined noticeably in all areas, especially Georges; the decline in 4VW may have been due to the closure of the fishery; as for the other areas, may have been driven mainly by bycatch nature of fishery;
  - roughly 30-50% of landings are bycatch as part of other fisheries; and,
  - no obvious change in length composition in 4X/5Y catch since 1993, although is somewhat larger for 1997 and 1998; no change evident in other regions as well.

- Catch at length across years
  - tabled by gear type.

- Longitudinal CPUE
  - standardized catch rate index since 1990 is very similar to RV weight per tow index over same time period; however RV index should be restricted to adult (fishable) biomass for the purposes of this comparison.

- Management issues, including shift in 4X effort
  - fish caught with LL in eastern 4X are smaller than those in western 4X; and,
  - recent increases in size composition of catch may be due to change in fishing location.

Abundance indices, length composition, distribution

- Summer RV; need to examine trends in biomass for 45+ cm fish for 4X/5
  - high proportion of trawlable biomass is found in 4X;
  - abundance trends in 4V and 4W low and similar;
  - recent abundance in 4X at record low levels;
  - white hake in 4V and 4W considerably smaller than those in 4X/5; and,
  - size composition in 4X has declined since 1995.

- Spring RV
  - similar decline since mid 1980s as summer RV.

- US spring and fall RV surveys
  - spring and fall surveys consistent, showing lower abundance after 1982 than before; however, neither RV survey is consistent with Canadian summer RV, which shows relatively high abundances after 1982.

- Canadian Georges Bank RV survey
  - has declined since 1987, and is now very low.

- ITQ survey

- 4VW sentinel survey

- 4Vn sentinel survey
  - declined since 1994, but high again in 1997.

- RV distribution by year in relation to depth and temperature
  - most were captured between 4-9 degrees and at depths of 200-320 m.

- Z calculations of 4X/5Z white hake RV based on Gulf of Maine growth curve as applied to commercial length frequencies and RV length frequencies.

4VsW Winter Skate (Simon)

Abundance indices and length composition

- Summer RV
  - variable from year to year; length modes difficult to follow across years;
  - 1998 point is lowest weight per tow value in time series;
  - recruitment index based on fish < 30 cm shows minimal recruitment overall, but some in 1993-94;
  - annual length frequencies suggest that larger fish have disappeared;
  - relative abundance in slope strata was virtually zero prior to 1986, increasing thereafter, suggesting that skates moved into deeper, warmer water or into 4X, after period of cold water (1986) started; however maps showed no apparent shift to 4X through time;
  - most recent 3-yr period (coincident with directed fishery) shows substantial decline in abundance in 4VW, but not in 4X; and,
  - ECNSAP data shows that there has been a monotonic decline in mean weight of winter skate since 1970; need to extend over past 4 years.

- Length compression plot to determine if larger skates have been lost; can also average 1995-98 RV length time series and compare with long-term mean; alternatively,

develop time series for 40+ and 60+ fish, so as to make it more comparable with industry and sentinel surveys
  - comparison of 1970-94 Vs 1995-98 shows that abundance of both small and large skates has declined in recent period; larger skates have clearly disappeared in both spring and summer RV, but only in 4VW, not 4X; and,
  - comparison of long-term mean of both spring and summer RV length composition with that of 1995-97 shows substantial loss of larger fish in both surveys.

- Has length frequency been distorted by low sampling of large catches? compare adjusted Vs unadjusted length frequencies to find out
  - changed some years (e.g.-Oct. '97), but not others; and,
  - length composition from directed fishery shows decline in mode since 1995, with loss of larger fish.

- Spring RV; need 1970-93 length composition compared to that of 1995-98 (excluding anomalous 1994 value)
  - modes and abundance not very consistent with that of summer RV;
  - highly variable as abundance and recruitment index;
  - distributed primarily along Shelf edge;
  - is possible that pre-1985 distribution was deeper than surveyed in spring RV, thus explaining apparent absence of winter skate before 1986; and,
  - ACON maps aggregated by 5-yr intervals show marked shift to Shelf edge and off banks since 1984.

- Spring and fall skate surveys
  - catches almost completely restricted to slope; very few sets allocated to Sable Island Bank, where sentinel survey caught most of its skates; therefore, the industry surveys may be too variable to provide an adequate index of abundance;
  - length composition of spring and fall surveys do not usually correspond; as well, there is absolutely no correspondence with length composition of matching sentinel surveys;
  - good correspondence between summer RV and spring industry in slope strata, showing decline since 1996;
  - distributional maps of spring and fall industry surveys shows that most of large catches are made in deepest strata, at edge of survey area; is quite possible that substantial numbers of skate occur in still deeper, unsurveyed waters; and,
  - conclude that industry survey results cannot be interpreted as yet.

The set allocation in the industry survey uses the same strata as that of the RV survey, which in turn appears to be inappropriate for use with winter skate, since it allocates very few sets to a major skate habitat (Sable Island Bank). **The WG recommends that the utility of the 1996-98 industry survey as an abundance index for winter skate be evaluated, and if found wanting, that the survey be redesigned.**

- 4VW sentinel survey
  - found winter skates only on Sable Island Bank in 1996 and 1997, yet thorny skate were captured both there and throughout 4VsW; have they been misidentified?;
  - subsequent investigation indicates that winter skate were probably misidentified as smooth skate;
  - were also concerns about accuracy of ID for other species (e.g.- little, thorny); therefore cannot use sentinel survey as abundance index
    catch rates have declined dramatically for all skate species between 1996 and 1997; however has done same for cod and haddock as well, suggesting that 1997 was a year of poor availability to the gear; and,
  - the fact that few large skates of any species were captured indicates that disappearance of large winter skates observed with other gears is supported.

- Calculate abundance index for all available surveys using only slope strata, split on either side of Gully
  - redfish surveys show relatively few winter skate at depths > 200 fm near Gully, but those surveys were before 1987 (e.g.- during period of warmer temperatures).

- Commercial CPUE by month and area
  - no substantial change in CPUE of combined skate species since 1994 in 4Vs or 4W.

- Fit length-based growth model to commercial length frequencies to derive initial estimate of Z; given concerns about accuracy of ages, resulting Z may be overestimated
  - use of several different growth models to estimate z produces rapidly increasing Zs between 1995-98, with 1998 Z of 0.63-1.00;
  - given that M is likely to be < 0.2, such high values of Z are completely unsustainable; and,
  - even if growth models are incorrect, trend in Z with year over duration of fishery indicates that mortality has increased markedly.

Biology

- Sexual maturity at length
  - 50% maturity at about 75 cm based on observer data;
  - length composition of landings has mode at or below 75 cm, suggesting that the majority of skates caught have not yet spawned; and,
  - the fact that fishing mortality before spawning is so high is more important for a species with few young than it would be for a more fecund species.

- Consider table of published catchabilities for use in estimating total biomass
  - shows that Nearing (unpub.) growth curve gives somewhat lower k than other values; therefore will use both sets to bracket range of values.

- Published age and growth of thorny skate as nearest biological analog; any evidence of sexual dimorphism?

Catch

- Landings and by-catch from IOP, pro-rated across all fleets
  - flatfish fishery in 1990s catches about 20% skate (all species) as bycatch, resulting in 200-300 mt bycatch, versus about 2000 mt total catch of all skate species; however, this does not include bycatch of fixed gear fisheries; and,
  - larger skates appear to have been lost since 1995.

- Need to table proportions of skate > 90 cm by year since 1995, when fishery started
  - substantial decline in proportion of larger skate since 1995.

- Table estimates of landings and bycatch by species for recent years, where ID's more reliable
  - virtually all of winter skate catch in past 4 years is directed, but was primarily bycatch before then.

4VWX Cusk (Comeau)

Catch

- Landings trends by division
  - Browns is one of the few places still producing cusk (directed by longliners), and they are very small;
  - catch has been completely unregulated, even in recent years; however, recent catch is at record low;
  - most of catch has been from mouth of Bay of Fundy, although are also caught throughout Scotian Shelf and on Georges; and,
  - fixed gear is major fishery.

- Length composition: need to restrict to 4X alone
  - no consistent evidence of loss of larger fish in recent years; however comparison with 1960s publication indicates that there has been a major compression of size composition.

Abundance indices and length composition

- Summer RV by division
  - catch per tow has declined steadily since 1977, and made sharp decline to record low levels since 1992; and,
  - abundance has declined in all divisions, not just 4X.

- Sentinel survey
  - virtually all of catches were at far western side of survey, near 4X border; and,
  - trend in catch rate over 3 years was inconclusive.

- ITQ survey
  - catch rate has remained steady or increased since 1995, in direct contrast to RV index; need to see them with confidence intervals, since trend is probably non-significant.

- Georges Bank RV

Biology

- Evidence for decreased reproductive output from SSIP, FEP, larval herring survey (**Hurley**)

- ECNSAP distribution by 5-yr blocks
  - mean weight has declined continuously since early 1980s.

- Review published age and growth
  - shows that are at least as long-lived as cod.

- Production model

Environment

- Review 1998 environmental conditions
  - Eastern Shelf continues to be cooler than average, although it's gradually warming; however, a cold pulse of water has cooled off most of 4X, particularly Emerald Basin, such that it is now below average as well. It is unknown how long these cool conditions will persist.